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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/808,554	03/25/2004	Kimmo Kansanen	60091.00294	4941

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EXAMINER	
SINGH, HIRDEPAL	

ART UNIT	PAPER NUMBER
2611	

MAIL DATE	DELIVERY MODE
09/26/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/808,554	KANSANEN ET AL.	
	Examiner	Art Unit	
	Hirdepal Singh	2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08). Paper No(s)/Mail Date *8/18/2005, 11/09/2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This action is in response to the filing date of March 25, 2004. Claims 1-22 are pending and have been considered below.

Information Disclosure Statement

2. The information disclosure statement filed November 09, 2006 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-7, 9, 11-16, 18 and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pan et al. (US 2005/0013347) in view of Yousef et al. (US 7,113,540) and further in view of Erving et al. (US 2002/0154716).

Regarding claims 1, 11 and 20-22:

Pan et al discloses a data processing apparatus and method for a channel equalizer (figure 1) of a receiver, the method comprising:

estimating interference from a received signal at a first observation time, creating a first covariance matrix (paragraph 0016) on the basis of the estimation and defining an inverse matrix (paragraph 0038) of the first covariance matrix and a Cholesky decomposition (paragraphs 0003,, 0047 and 0054) matrix;

removing selected covariance components from the Cholesky decomposition matrix (48, 52, 54 in figure 2; paragraph 0054);

generating an output value of the channel equalizer (paragraph 0055; also clearly claimed in claim 31) by utilizing information obtained with the aid of the Cholesky decomposition of the inverse matrix of the second covariance matrix.

Pan et al discloses all of the subject matter as described above except for specifically teaching that method comprises: computing the inverse of a sub-matrix, which represents the common part of the first covariance matrix and a second covariance matrix, which includes covariance estimates of a second observation time, by using the aid of the Cholesky decomposition of the inverse matrix of the first covariance matrix; estimating interference from a received signal at a second

observation time and determining additional covariance components on the basis of the estimation; creating the Cholesky decomposition of the inverse matrix of the second covariance matrix by using unitary rotations.

However, Yousef et al in the same field of endeavor discloses a method and apparatus for equalizer where inverse of a sub-matrix (column 7; lines 30-35), which represents the common part of the first covariance matrix and a second covariance matrix, which includes covariance estimates of a second observation time, by using the aid of the Cholesky decomposition of the inverse matrix of the first covariance matrix.

Erving et al in the same field of endeavor discloses a system and method for equalizer with calculating inverse of a sub-matrix, which represents the common part of the first covariance matrix and a second covariance matrix (figure 6; paragraph 022), which includes covariance estimates of a second observation time, by using the aid of the Cholesky decomposition (paragraph 0046) of the inverse matrix of the first covariance matrix and further discloses estimating interference from a received signal at a second observation time and determining additional covariance components on the basis of the estimation (paragraphs 0018 and 0058), also creating the Cholesky decomposition of the inverse matrix (paragraphs 0022 and 0044) of the second covariance matrix by using unitary rotations.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to compute the inverse of a sub-matrix, which represents the common part of the first covariance matrix and a second covariance matrix by using the Cholesky decomposition of the inverse matrix of the first covariance matrix and estimate

interference from a received signal at a second observation time and determine additional covariance components on the basis of the estimation to create the Cholesky decomposition of the inverse matrix of the second covariance matrix by using unitary rotations in order to make the system reliable and make the inter symbol interference at a minimal level at the same time keeping the system simple by avoiding implementation through complex hardware/algorithm while obtaining high performance.

Regarding claim 2:

Pan et al discloses all of the subject matter as described above except for specifically teaching that system further comprising means for filtering additional covariance components.

However, Erving et al in the same field of endeavor discloses a system and method for equalizer with means for filtering (paragraphs 0024 and 0034) additional covariance components.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to use the filtering of additional covariance components in order to make the signal output of receiving arrangement without any error caused by interference and improving the quality.

Regarding claims 3 and 12:

Pan et al discloses all of the subject matter as described above except for specifically teaching that the Cholesky decomposition of the inverse matrix of the first

covariance matrix of the specific form (described in equation 3 of specification paragraph 0035.

However, Yousef et al in the same field of endeavor discloses a method and apparatus for equalizer where Cholesky decomposition of the inverse matrix of the first covariance matrix is of the form (as shown in equation 10-11; column 6, lines 55-67; coluesm7, lines 1-12; column 4, lines 34-42).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to use the decomposition matrix of the form as above in Yousef in order to compute the coefficient of the filter in a effective manner and keep the algorithm simple as in this case by using a lower triangular matrix.

Regarding claims 4 and 13:

Pan et al discloses all of the subject matter as described above and further discloses that partitioning the inverse matrix of the first covariance matrix is described as (paragraph 0018).

Regarding claims 5 and 14:

Pan et al discloses all of the subject matter as described above except for specifically teaching that the selection of the covariance components to be removed is based on the size of the sliding step of a signal window.

However, Erving et al in the same field of endeavor discloses a system and method for equalizer where selection of the covariance components to be removed is based on the size of the sliding step of a signal window (paragraph 0037).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to use the selection of the covariance components to be removed based on the size of the sliding step of a signal window to get better response with a given number of taps of the window function.

Regarding claims 6 and 15:

Pan et al discloses all of the subject matter as described above and further discloses that determining additional covariance components as (described in equation 12, 13, 20, 21; paragraphs 0012 and 0016).

Regarding claims 7 and 16:

Pan et al discloses all of the subject matter as described above and further discloses that the computation of the inverse of the sub-matrix representing the common part of the two consecutive covariance matrices With the aid of determination of sub matrix and its complex conjugate (paragraphs 0038 and 0047; equations 23-24).

Regarding claims 9 and 18:

Pan et al discloses all of the subject matter as described above and further discloses that the output signal of an equalizer is generated as (equation 23-24 and 28-29).

5. Claims 8, 10, 17 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pan et al. (US 2005/0013347) in view of Yousef et al. (US 7,113,540) further in view of Erving et al. (US 2002/0154716) as applied to claims 1 and 11 above, and further in view of Deligne et al. (US 6,622,117).

Regarding claims 8 and 17:

Pan et al discloses all of the subject matter as described above except for specifically teaching that Cholesky factorization of the inverse matrix of the second covariance matrix as in equation 8, paragraph 0047 of specification.

However, Deligne et al in the same field of endeavor discloses a system and method for equalizer where Cholesky factorization of the inverse matrix of the second covariance matrix is described (column 10, lines 36-46).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to use Cholesky factorization of the inverse matrix of the second covariance matrix as described with a upper triangular matrix in order to keep the implementation of the method based on the cholesky algorithm simple and less complex.

Regarding claims 10 and 19:

Pan et al discloses all of the subject matter as described above except for specifically teaching that the output value of the channel equalizer is generated by further utilizing a-priori symbol estimate information.

However, Deligne et al in the same field of endeavor discloses a system and method for equalizer where the output value of the channel equalizer is generated by further utilizing a-priori symbol estimate information (column 13, lines 55-60).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to output value of the channel equalizer by further utilizing a-priori symbol estimate information in order to eliminate the use of unknown number of matrix filters which makes the system simple and inexpensive.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hirdepal Singh whose telephone number is 571-270-1688. The examiner can normally be reached on Mon-Fri (Alternate Friday Off)8:00AM-5:00PMEST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shuwang Liu can be reached on 571-272-3036. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

HS
September 18, 2007

SHUWANG LIU
SUPERVISORY PATENT EXAMINER